**Claims:**

1. A system for handling wafers, each wafer having a periphery, an underside, an upper surface, and a surface area, the system comprising:

a wafer table assembly comprising a wafer table providing a planar wafer table surface configured for carrying a wafer, the wafer table assembly configured for selectively applying one of:

(i) ~~applying~~ a negative pressure ~~or a positive pressure~~ to ~~an~~ the underside of the wafer for retaining the wafer on the wafer table surface, and

(ii) a positive pressure to the underside of the wafer after cessation of the application of the negative pressure to the wafer for facilitating release of the wafer from the wafer table surface; and

a flattening apparatus configured for automatically applying a set of downward forces to portions of a warped or non-planar wafer disposed on the wafer table surface in a direction normal to the wafer table surface, the flattening apparatus comprising a plurality of tip elements,

wherein the tip elements are (a) collectively displaceable to multiple distinct positions transverse to and towards or away from a vertical axis perpendicular to the wafer table surface, and (b) selectively contactable with the warped or non-planar wafer on the wafer table surface at peripheral portions of the upper surface of the warped or non-planar wafer; and

wherein the flattening apparatus eliminates a need for manual intervention when the warped or non-planar wafer cannot be reliably retained on the wafer table surface as a result of ~~its~~ the wafer's warpage or non-planarity.

2. The system of claim 1, wherein the flattening apparatus is further configured for automatically applying the set of downward forces concurrently with the application of the negative pressure to the underside of the wafer by the wafer table assembly.

~~2~~3. The system of claim 1, wherein the wafer table surface comprises a porous material.

~~3~~4. The system of claim 1, wherein the flattening apparatus comprises:

a main body positionable over the wafer table surface and displaceable along ~~a~~ the vertical axis ~~that is perpendicular to the wafer table surface~~;

a plurality of arms coupled to the main body, each arm within the plurality of arms ~~having~~ carrying a corresponding tip element comprising a soft and resiliently deformable material ~~coupled thereto~~, each arm controllably displaceable to multiple distinct positions transverse to and towards or away from the vertical axis;

a vertical displacement driver configured for (a) controllably displacing the main body and consequently simultaneously displacing the plurality of arms and the tip elements coupled thereto along a vertical direction parallel to the vertical axis to position the tip elements in accordance with an engagement assistance position corresponding to a dimension of the wafer retained upon the wafer table, such that a portion of each tip element is disposed directly over ~~an~~ the exposed upper surface of the wafer for engaging with or contacting a ~~portion of~~ selected distinct location on the exposed upper surface of the wafer, and (b) controllably displacing the tip elements positioned in accordance with the engagement assistance position in a downward direction toward the wafer table surface for applying the set of downward forces on each selected distinct location of the wafer.

5. The system of claim 4, wherein each arm and each tip element corresponding thereto includes a passage therein configured for communicating a vacuum force therethrough.

~~4~~6. The system of claim ~~3~~4, wherein the plurality of tip elements is displaceable to

a plurality of engagement assistance positions, each engagement assistance position disposing the tip elements away from each other across an area that is slightly less than a standard wafer diameter at the periphery of the wafer on the wafer table surface,

wherein each engagement assistance position corresponds to a different standard wafer dimension.

~~5~~7. The system of claim 1, further comprising a displacement limitation apparatus configured for automatically constraining or preventing uncontrolled lateral displacement of the wafer ~~relative to~~along the wafer table surface after cessation of ~~an~~ the ~~applied~~ negative pressure and/or

~~an~~ the application of ~~a~~ the positive pressure to the underside of the wafer via the wafer table, to thereby eliminate a need for manual intervention in response to such uncontrolled lateral displacement of the wafer.

~~6~~8. The system of claim ~~5~~7, wherein the displacement limitation apparatus comprises:

a main body positionable over the wafer table surface and displaceable along ~~a~~ the vertical axis ~~that is perpendicular to the wafer table surface~~;

a plurality of arms coupled to the main body, each arm within the plurality of arms ~~having~~ carrying a corresponding tip element comprising a soft and resiliently deformable material ~~coupled thereto~~, each arm controllably displaceable to multiple distinct positions transverse to and towards or away from the vertical axis; and

a vertical displacement driver configured for (a) controllably displacing the main body and consequently simultaneously displacing the plurality of arms and the tip elements coupled thereto along a vertical direction parallel to the vertical axis to position the tip elements in accordance with a confinement configuration corresponding to a dimension of the wafer retained upon the wafer table, such that each tip element is disposed slightly beyond the periphery of the wafer, and (b) controllably displacing the tip elements positioned in accordance with the confinement configuration in a downward direction toward the wafer table surface.

~~7~~9. The system of claim ~~6~~8, wherein the tip elements are displaceable to a plurality of confinement configurations, each confinement configuration disposing the tip elements away from each other across a planar spatial confinement area that is marginally larger than the surface area of the wafer on the wafer table surface, wherein each confinement configuration corresponds to a different standard wafer dimension.

~~8~~10. The system of claim ~~5~~7, wherein the wafer table assembly includes a set of ejector pins displaceable along ~~a~~ the vertical direction ~~perpendicular to the wafer table surface~~parallel to the vertical axis, and wherein the displacement limitation apparatus comprises:

a control unit configured for controlling:

(a) ~~an~~ the application of ~~an air puff~~the positive pressure to the underside of the wafer essentially immediately after interruption or cessation of the application of the ~~suction force~~negative pressure to the underside of the wafer, the ~~air puff~~positive pressure applied from an ~~air puff~~ onset time to ~~an air puff~~a cessation time; and

(b) activation of the set of ejector pins to displace the set of ejector pins in an upward direction after ~~a very brief~~an ejector pin activation delay time following the ~~air puff~~ onset time to thereby lift the wafer ~~off of~~away from the wafer table surface with minimal or negligible lateral displacement as a result of the ~~very brief~~ ejector pin activation delay time relative to the ~~air puff~~ onset time,

wherein the ejector pin activation delay time is precisely controlled relative to the ~~air puff~~ onset time such that the wafer is vertically raised away from the wafer table surface synchronous with the release of the wafer from the wafer table surface in response to the ~~air puff~~positive pressure.

~~9~~11. The system of claim ~~8~~10, wherein the ejector pin activation delay time is experimentally determined.

~~10~~12. The system of claim ~~8~~10, wherein the ejector pin activation delay time is between 5 – 50 msec.

~~11~~13. A method for handling wafers, each wafer having a periphery, an underside, an upper surface, and a surface area, the method comprising:

transporting a wafer to a planar wafer table surface corresponding to a wafer table assembly comprising a wafer table, the wafer table assembly configured for selectively applying one of:

(i) ~~applying~~ a negative pressure ~~or a positive pressure~~ to ~~an~~ the underside of the wafer for retaining the wafer on the wafer table surface; and

(ii) a positive pressure to the underside of the wafer after cessation of the application of the positive pressure to the wafer for facilitating release of the wafer from the wafer table surface; ~~and~~

collectively displacing a plurality of tip elements to multiple distinct positions transverse to and towards or away from a vertical axis perpendicular to the wafer table surface;

selectively contacting with the warped or non-planar wafer on the wafer table surface at peripheral portions of the upper surface of the warped or non-planar wafer;

automatically applying a set of downward forces to portions of a warped or non-planar wafer disposed on the wafer table surface in a direction normal to the wafer table surface; and

automatically remediating insufficient retention of the wafer upon the wafer table surface due to wafer's warpage or non-planarity, thereby eliminating a need for manual intervention.

~~12~~14. The method of claim ~~11~~13, wherein automatically remediating insufficient retention of the wafer upon the wafer table surface comprises:

automatically detecting insufficient retention of the wafer upon the wafer table surface; and

responsively applying ~~a~~ the set of downward forces to portions of ~~an~~ the exposed upper surface of the wafer concurrently with the application of the ~~suction force~~negative pressure to the underside of the wafer to facilitate secure retention of the wafer upon the wafer table surface.

~~13~~15. The method of claim ~~12~~14, wherein applying the set of downward forces comprises:

positioning a flattening apparatus above the wafer, the flattening apparatus comprising a housing coupled to a plurality of displaceable arms, each arm within the plurality of arms ~~coupled to~~carrying a corresponding tip element comprising a soft and resiliently deformable material;

positioning the tip elements in accordance with an engagement assistance position corresponding to a dimension of the wafer upon the wafer table, such that a portion of each tip element is disposed directly over the exposed upper surface of the wafer for engaging with or contacting a ~~portion~~ selected distinct location ~~of~~ on the exposed upper surface of the wafer; and

displacing the tip elements disposed over the exposed upper surface of the wafer downward toward the wafer table surface for applying the set of downward forces on each selected distinct location of the wafer.

16. The method of claim 15, further comprising communicating a vacuum force through a passage in each arm and each tip element corresponding thereto.

~~14~~17. The method of claim ~~12~~14, further comprising:

detecting secure retention of the wafer upon the wafer table surface by way of a vacuum gauge; and

terminating the application of the set of downward forces ~~to portions of~~on the exposed upper surface of the wafer in response to secure retention of the wafer on the wafer table surface.

~~15~~18. The method of claim ~~11~~13, further comprising automatically preventing uncontrolled lateral displacement of the wafer relative to the wafer table surface following interruption or cessation of the ~~suction force~~negative pressure and/or ~~an~~ the application of the positive pressure to the underside of the wafer.

~~16~~19. The method of claim ~~15~~18, wherein automatically preventing uncontrolled lateral displacement of the wafer relative to the wafer table surface comprises:

positioning a confinement apparatus above the wafer, the confinement apparatus comprising a housing coupled to a plurality of displaceable arms, each arm within the plurality of arms ~~coupled to~~carrying a corresponding tip element comprising a soft and resiliently deformable material;

positioning the tip elements in accordance with a confinement configuration corresponding to a dimension of the wafer retained upon the wafer table, such that a portion of each tip element is disposed just beyond the periphery of the wafer;

interrupting or terminating the application of ~~suction force~~the negative pressure to the underside of the wafer; and

activating a set of ejector pins corresponding to the wafer table in an upward direction to elevate the wafer away from the wafer table surface.

~~17~~20. The method of claim ~~15~~18, wherein automatically preventing uncontrolled lateral displacement of the wafer relative to the wafer table surface comprises:

interrupting or terminating the application of ~~suction force~~the negative pressure to the underside of the wafer;

applying ~~an air puff~~the positive pressure to the underside of the wafer essentially immediately after interruption or cessation of the application of the ~~suction force~~negative pressure to the underside of the wafer, the ~~air puff~~positive pressure applied from an ~~air puff~~ onset time to ~~an air puff~~a cessation time; and

activating a set of ejector pins corresponding to the vacuum table to displace the set of ejector pins in an upward direction after ~~a very brief~~an ejector pin activation delay time following the ~~air puff~~ onset time to thereby lift the wafer off of the wafer table surface with minimal or negligible lateral displacement as a result of the ~~very brief~~ ejector pin activation delay time relative to the ~~air puff~~ onset time, wherein the ejector pin activation delay time is precisely controlled relative to the ~~air puff~~ onset time such that the wafer is vertically raised away from the wafer table surface synchronous with the release of the wafer from the wafer table surface in response to the ~~air puff~~positive pressure.

~~18~~21. The method of claim ~~17~~20, wherein the ejector pin activation delay time is experimentally determined.

~~19~~22. The method of claim ~~17~~20, wherein the ejector pin activation delay time is between 5 – 50 msec.

~~20~~23. A method for handling a wafer in association with an inspection process, comprising:

retrieving the wafer from a wafer source;

transporting the wafer to a wafer prealigner;

disposing the wafer on a wafer table surface provided by a wafer table following prealignment of the wafer;

applying a negative pressure to an underside of the wafer for retaining the wafer on the wafer table surface;

automatically remediating insufficient retention of the wafer upon the wafer table surface due to wafer warpage or non-planarity by way of:

detecting whether the wafer is securely retained upon the wafer table surface prior to the initiation of the inspection process; and

collectively displacing a plurality of tip elements to multiple distinct positions transverse to and towards or away from a vertical axis perpendicular to the wafer table surface;

selectively contacting with the warped or non-planar wafer on the wafer table surface at peripheral portions of the upper surface of the warped or non-planar wafer; and

automatically applying a set of downward forces to portions of the wafer disposed on the wafer table surface in a direction normal to the wafer table surface until secure retention of the wafer upon the wafer table surface is detected;

and

automatically preventing uncontrolled lateral displacement of the wafer along the wafer table surface following the inspection process as a result of cessation of the application of the negative pressure to the wafer by way of:

(a) automatically confining the wafer to reside within a confinement position on the wafer table; or

(b) coordinating the cessation of the application of the negative pressure to the underside of the wafer with an application of ~~an air puff~~a positive pressure to the underside of the wafer and an activation of a set of ejector pins that is vertically displaceable relative to the wafer table surface, such that the wafer is vertically raised away from the wafer table surface synchronous with the release of the wafer from the wafer table surface in response to the ~~air puff~~positive pressure;

and

retrieving the wafer from the wafer table and transferring the wafer to a wafer destination.

24. The method of claim 23, wherein the set of downward forces is automatically applied concurrently with the application of the negative pressure to the underside of the wafer, in response to detecting insufficient retention of the wafer upon the wafer table surface.